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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to a low dielectric constant glass constituent suitable as a dielectric formation material of the discharge-in-gases space of discharge-in-gases display especially about a low dielectric constant glass constituent.
[0002]
[Description of the Prior Art] Conventionally, as display of an electronic formula, although CRT is mainly used, CRT has faults, like that appearance capacity is large, heavy being a thing, and the high voltage is required. Therefore, in recent years, appearance capacity is small, flat-surface display, such as light emitting diode (Light Emitting Diode) which can be used on lightweight and low voltage, a liquid crystal display element (LCD), and a plasma display panel (PDP), is developed, and these use ranges are being expanded quickly.
[0003] The discharge-in-gases display known in the name of PDP also in such flat-surface display is a self-luminescence type, and is considered as most promising display from the reason a display being legible and large-area-izing are easy.
[0004] As for PDP, a vertical electrode and a horizontal electrode are formed between two sheet glass of a front board and a tooth-back board, and these electrodes have the structure covered with the dielectric layer. This dielectric layer not only protects an electrode, but has the role of starting or maintaining display electric discharge.
[0005] Since it is required that it should have the permeability which was excellent in the material which forms this dielectric layer in order to use efficiently the light emitted from the fluorescent substance in discharge-in-gases space for the dielectric materials formed in a having-high insulating property as electronic-parts material, especially front board side as a display light, generally amorphous glass is used.
[0006] After a dielectric layer makes the end of a glass powder the shape of a paste, although formed by applying on sheet glass and calcinating, in order to suppress a reaction with an electrode to the minimum, it is desirable [ the temperature at the time of calcinating ] that it is the temperature near glass softening temperature. By the way, as sheet glass of PDP, since aperture plate glass (soda lime glass) with easy acquisition is generally used, it is required for the glass which forms a dielectric layer that softening temperature should be 600 degrees C or less. That is, it is because the viscosity of sheet glass is fallen and stabilized at the time of baking and it becomes impossible to form a dielectric layer at it when the softening temperature of glass is 600 degrees C or more, since it will be necessary to calcinate at the temperature of 600 degrees C or more.
[0007] Moreover, since distortion occurs to the both sides of a dielectric layer and sheet glass, sheet glass curves or there is a possibility that a crack may occur when the coefficient of thermal expansion of this glass is greatly different from it of sheet glass, it is also required that a coefficient of thermal expansion should be 65 - 85x10-7/degree C (30-300 degrees C).
[0008]
[Problem(s) to be Solved by the Invention] By the way, although the dielectric constant of the glass which forms the dielectric layer for starting or maintaining display electric discharge needed to be made as low as possible in order to have made power consumption of PDP equivalent to it of CRT, since the glass used conventionally usually contained heavy elements, such as PbO, so much, the dielectric constant was high [ glass ].
[0009] For example, although the glass constituent used for the dielectric layer of PDP is indicated by JP,3-170346,A, since PbO is contained 55% of the weight or more, a dielectric constant is high and, as for PDP which used this for the dielectric layer, power consumption tends to become large.
[0010] Moreover, the zinc borosilicate-glass constituent used for the dielectric layer of PDP is indicated by JP,2-1100,B, and this constituent is not considered at all about making a dielectric constant low, although it is setting not to include PbO to one of the features since it says that lead glass reduces quality working [ equipment ], or injures the health of environment and human being.
[0011] this invention is made in view of the above-mentioned situation, its permeability after baking is high and it has the softening temperature of 600 degrees C or less, and a 65 - 85x10-7 degree C coefficient of thermal expansion, and since a dielectric constant is moreover seven or less, it aims at offering a glass constituent suitable as a material which forms the dielectric layer of PDP.
[0012]

[Means for Solving the Problem] this invention person is B-2 O3 about a zinc borosilicate-glass constituent, as a result of repeating various experiments that the above-mentioned purpose should be attained. It finds out that a dielectric constant can be fallen and came to propose this invention, so that it increased.
[0013] Namely, the low dielectric constant glass constituent of this invention is a weight percent, and ZnO. 25 - 45%, and B-2 O3 35 - 55%, SiO2 5 - 13%, aluminum 2O3 0.5 - 5%, alkali-metal oxide It is characterized by having 2 - 20% of composition.
[0014] Moreover, the low dielectric constant glass constituent of this invention is characterized by being used as a dielectric formation material of the discharge-in-gases space of discharge-in-gases display.
[0015]
[Function] The reason which limited the composition range of the glass constituent of this invention as mentioned above is as follows.
[0016] ZnO is a component which lowers a coefficient of thermal expansion, without getting the melting temperature and softening temperature of glass remarkably, and the content is 25 - 45%. If [ than 45% ] more [ it will become deficient in the above-mentioned effect if fewer than 25%, and ], since a crystal deposits in glass and it becomes easy for permeability to fall, it is not desirable.
[0017] B-2 O3 It is the principal component which forms the glass structure, and is the component which lowers the melting temperature, the softening temperature, and the dielectric constant of glass, and the content is 35 - 55%. If fewer than 35%, it will become deficient in the above-mentioned effect, and if [ than 55% ] more, glass will carry out phase splitting and it will become easy for permeability to fall.
[0018] SiO2 It is a component indispensable to formation of the glass structure, and the content is 5 - 13%. If [ than 13% ] more, since vitrification will become difficult if fewer than 5%, and the softening temperature of glass will become high too much, it is not desirable.
[0019] aluminum 2O3 It is the component which stops the phase separation of glass, and the content is 0.5 - 5%. If fewer than 0.5%, it will become deficient in the above-mentioned effect, and if [ than 5% ] more, a crystal will deposit and it will become easy for permeability to fall into glass.
[0020] Alkali-metal oxides, such as Li2 O, Na2 O, and K2 O, are components which lower the softening temperature of glass, and the content is 2 - 20%. If [ than 20% ] more [ it will become deficient in the above-mentioned effect if fewer than 2%, and ], while a coefficient of thermal expansion will rise, since electric insulation falls, it is not desirable.
[0021] Moreover, in this invention, it is the range which does not spoil an expected property besides the above-mentioned component, and it is also possible to add a component called MgO, CaO, SrO, and BaO which are an alkaline-earth-metal oxide to 10%.
[0022]
[Example] Hereafter, the low dielectric constant glass constituent of this invention is explained in detail based on an example.

[0023] Table 1 shows the glass constituent (sample No.1-8) of an example, and the glass constituent (9 sample No. 10) of the example of comparison.
[0024]
[Table 1]

(重量%)

| 試料No. / 組成 | 実施例 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 比較例 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ZnO | 33.3 | 40.9 | 29.3 | 32.1 | 27.2 | 43.1 | 26.6 | 32.3 | 8.3 | 38.2 |
| $B_2O_3$ | 41.7 | 37.8 | 51.2 | 44.3 | 45.5 | 35.2 | 53.4 | 47.0 | 17.4 | 23.9 |
| $SiO_2$ | 12.6 | 7.7 | 7.6 | 9.8 | 11.1 | 6.8 | 8.1 | 9.2 | 9.5 | 12.8 |
| $Al_2O_3$ | 1.3 | 1.1 | 2.5 | 1.9 | 3.4 | 0.9 | 3.1 | 2.0 | − | 4.1 |
| $Li_2O$ | 1.4 | − | 6.2 | − | 2.3 | 2.3 | 1.2 | 5.7 | − | 2.0 |
| $Na_2O$ | 7.5 | 11.6 | 1.8 | 8.2 | 2.2 | 10.5 | 6.8 | 1.8 | − | 11.2 |
| $K_2O$ | − | − | 1.8 | 3.7 | 3.7 | 1.2 | − | − | − | 3.4 |
| MgO | − | − | − | − | 1.1 | − | − | 0.8 | − | − |
| CaO | 2.2 | − | − | − | − | − | − | 1.2 | − | 8.4 |
| SrO | − | − | − | − | − | − | 0.9 | − | − | − |
| BaO | − | 0.7 | − | − | 3.5 | − | − | − | − | − |
| PbO | − | − | − | − | − | − | − | − | 64.8 | − |
| 熱膨張係数 ($\times10^{-7}$/℃) | 72 | 83 | 71 | 79 | 83 | 70 | 53 | 68 | 80 | 83 |
| 軟化点 (℃) | 570 | 575 | 525 | 565 | 580 | 515 | 570 | 595 | 505 | 535 |
| 透過率 (%) | 80 | 79 | 80 | 83 | 78 | 78 | 73 | 81 | 88 | 79 |
| 誘電率 | 6.8 | 6.7 | 6.4 | 6.7 | 6.5 | 7.0 | 6.5 | 6.4 | 11.7 | 7.7 |

[0025] Each sample of front Naka was produced as follows.
[0026] The raw materials for glass was prepared so that it might become oxide composition of Table 1 first, and it fully mixed. Any of an oxide, a carbonate, or a nitrate are sufficient as each raw material. Next, after paying the mixed raw material to the platinum crucible and fusing at 1250 degrees C, melting glass was poured to the metal mold made from stainless steel, and broth fabrication was carried out.
[0027] In the 30-300-degree C temperature requirement, it had the 68 - 83x10-7/degree C coefficient of thermal expansion, and softening temperature was 595 degrees C or less, each sample of No.1-8 which are an example had the high permeability after baking, and, moreover, its dielectric constant was all as low as seven or less so that clearly from a table.
[0028] Each sample of 10 had the high dielectric constant compared with each sample of an example in No.9 which are an example of comparison to it.
[0029] In addition, the coefficient of thermal expansion of front Naka carries out polish processing of the fabricated vitreous humour at the shape of a pillar with a diameter [ of 4mm ], and a length of 40mm, and measures the coefficient of thermal expansion of a 30-300-degree C temperature requirement using a pusher-bar formula coefficient-of-thermal-expansion measuring device.
[0030] Moreover, after softening temperature ground the vitreous humour with the alumina mortar, the powder glass obtained by classifying by the screen of 45 micrometers of openings was used for it, it measured it using the macro mold differential thermal analyzer, and showed the value of the second endothermic peak.
[0031] Furthermore, by pulverizing a vitreous humour with the ball mill made from an alumina, permeability was made powdered, mixed this powder glass in 5% terpineol solution of an ethyl cellulose, and kneaded and pasted it by 3 roll mills. Subsequently, after applying this paste on sheet glass (soda lime glass) with screen printing and putting it in into an electric furnace, by calcinating at the temperature near softening temperature, about 30-micrometer glass membrane is formed and the permeability in 590nm orange light is measured using the integrating sphere of a spectrophotometer.
[0032] Furthermore, the dielectric constant carried out polish processing of the fabricated vitreous humour at 2.0mm ** and the shape of a disk with a diameter of 30mm, formed the electrode with a diameter of 20mm in both sides of this disk-like glass, and measured it using the LCR meter.
[0033]
[Effect of the Invention] As mentioned above, a coefficient of thermal expansion is [ 65 - 85x10-7 degree C and softening temperature ] 600 degrees C or less, and the low dielectric constant glass constituent of this invention has the high permeability after baking, and since a dielectric constant is moreover seven or less, it is suitable as a dielectric formation material of the discharge-in-gases space of discharge-in-gases display.

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[Translation done.]

* NOTICES *



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3.In the drawings, any words are not translated.

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CLAIMS

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[Claim(s)]
[Claim 1] At a weight percent, it is ZnO. 25 - 45%, and B-2 O3 35 - 55%, SiO2 5 - 13%, aluminum 2O3 Low dielectric constant glass constituent characterized by having composition of 2 - 20% of alkali-metal oxides 0.5 to 5%.
[Claim 2] The low dielectric constant glass constituent according to claim 1 characterized by being used as a dielectric formation material of the discharge-in-gases space of discharge-in-gases display.

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MEANS

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OPERATION

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[0020] Alkali-metal oxides, such as Li2 O, Na2 O, and K2 O, are components which lower the softening temperature of glass, and the content is 2 - 20%. If [ than 20% ] more [ it will become deficient in the above-mentioned effect if fewer than 2%, and ], while a coefficient of thermal expansion will rise, since electric insulation falls, it is not desirable.
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## EXAMPLE

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（重量%）

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| $Na_2O$ | 7.5 | 11.8 | 1.8 | 8.2 | 2.2 | 10.5 | 6.8 | 1.8 | − | 11.2 |
| $K_2O$ | − | − | 1.8 | 3.7 | 3.7 | 1.2 | − | − | − | 3.4 |
| MgO | − | − | − | − | 1.1 | − | − | 0.8 | − | − |
| CaO | 2.2 | − | − | − | − | − | − | 1.2 | − | 8.4 |
| SrO | − | − | − | − | − | − | 0.9 | − | − | − |
| BaO | − | 0.7 | − | − | 3.5 | − | − | − | − | − |
| PbO | − | − | − | − | − | − | − | − | 64.8 | − |
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